

On  
A New Echiuroid (*Hamingia ijimai*)  
from the Sagami Bay.

BY

I. Ikeda.

(With Plate I).

In the summer of 1908 I had a good opportunity to study an interesting deep-sea Echiuroid which was fished by Mr. K. Aoki, in February of 1907, from a 500 fathom basin of Outside Okinose in the Sagami Bay. Closer examination has revealed that the animal is undoubtedly a new form belonging to the genus *Hamingia*, a genus characterized by sexual dimorphism like the sister genus *Bonellia*. Only two species have been described in *Hamingia*, viz., *H. arctica* Danielsen et Koren<sup>1</sup> and *H. sibogae* Sluiter.<sup>2</sup> (*H. glacialis* Horst,<sup>3</sup> described from two specimens collected by the "Willem Barent," was later proved to be identical with *H. arctica*). It may here be noted that the two species have been obtained from localities widely separated and from different depths; *H. arctica* was obtained in comparatively shallow waters of the Arctic sea (a few hundred miles north of North Cape) and of Hardanger Fjord,<sup>4</sup> while *H. sibogae* came from an abyssal depth (4391 metres) of the Banda

1. Danielsen, D.C., and Koren, J.—The Norwegian North Atlantic Expedition, 1876—1878; *Gephyrea* (Zoology), 1881, Christiania.

2. Sluiter, C. Ph.—Die Sipunculiden und Echiuriden der Siboga Expedition (Siboga Expeditie, XXV, 1902).

3. Horst, R.—Die Gephyrea gesammelt während der zwei ersten Fahrten des "Willem Barent" (Niederländ. Archiv für Zoologie, Suppl. Bd. 42-1881).

4. Lankester, E. R.—On Specimens of the Gephyrean *Hamingia arctica* Kor. and Dan. from the Hardanger Fjord (Ann. and Mag. of Nat. Hist., 5, XI, 1883).

Sea ( $5^{\circ} 44' 7''$  S and  $126^{\circ} 27' 3''$  E). The new species, to be presently described, comes from a depth (500 fathoms) intermediate between the above two. For it I propose the name *Hamingia ijimai* in honor of Professor Ijima of the Tokyo Imperial University.

*Hamingia ijimai* nov. sp.

The animal in the preserved state (Fig. 1) measures about 160 mm in total length, of which 60 mm. form the length of the proboscis. As is seen in the figure, the body proper is preserved in a somewhat unnatural state, the anterior half being considerably contracted, while the posterior half is abnormally distended. According to the collector's remark, the animal when alive was of a bright yellowish red color, a faint trace of which is still preserved in the alcoholic specimen. The integument is thin, translucent and quite smooth, except on the proboscis and in the contracted region of the body. It is devoid of any sort of papillary structures and of hooks.

About 8 mm. behind the funnel-shaped mouth lies a small pit, situated at the posterior end of a narrow groove running from the posterior cleft of the mouth and along the median ventral line (see Fig. 1). This is the external opening of the single oviduct. The anus lies at the usual position, i.e., at the apex of the conical hind region of the body.

The proboscis is relatively long and slender, measuring, when straightened, 60 mm. in length and 6 mm. in width. The organ was in the living state, as I was told, at least twice as long as it is now, and was performing an incessant undulatory movement recalling that of *Thalassema taenioides*.<sup>1</sup> It terminates rounded at the anterior end and has a deep groove along the entire length of the ventral side.

The alimentary canal winds and twists in a very complex way

1. Ikeda, I.—On Three New and Remarkable Species of Echiuroids (*Bonellia miyajimai*, *Thalassema taenioides* and *T. elegans*): Journ. Coll. Sci., Imp. Univ., Tokyo, Japan, Vol. XXI, Art. 8, 1907.

and is fixed to the integument by very numerous thread-like and membranous muscles, the latter being present especially at the places where it lies close to and nearly parallel with the ventral nerve-cord. The manner of winding and the relative length of different parts of the alimentary canal is, on the whole, as in *Hamingia arctica* and in many species of *Thalassema*. The whole canal may conveniently be divided into three parts; the fore-gut (incl. pharynx, oesophagus, crop, etc. of other workers), the mid-gut with the collateral intestine, and the hind-gut with the ciliated groove. These three parts are respectively 27.5 cm., 30 cm. and 35 cm. long. Owing to the U-shaped bending of the posterior portion of the fore-gut, the junction of the latter with the mid-gut is brought considerably forwards (see Fig. 4). The description and figures given by Danielsen and Koren of the pharynx of *Hamingia arctica* may be said to be directly applicable to that of the present species. The pharynx (Fig. 4, *ph*) is a large oblong and highly muscular sac measuring 20 mm. in length and 11 mm. in maximum diameter, and is firmly fixed to the integument by numerous radial muscles.

The anal glands, which are found in the usual position, show some peculiarities. From the terminal portion of the rectum arise three main canals on each side, each giving off secondary and tertiary branches before ending with the funnels. Fig. 2 represents the main as well as the principal secondary and tertiary canals (see right-hand side) in natural position. There are on each side two larger, antero-ventral (*av*) and postero-dorsal canals (*pd*), and one smaller, mid-lateral (*ml*) main canal. The two antero-ventral canals run so ventral that they make very acute angles with the ventral nerve-cord (*vnc*). As may be seen on the left-hand side of the above figure, the three canals seem to originate independently from a narrow and thin-walled outgrowth (*rd*) of the rectum. It seems probable that this saccular outgrowth, one on each side, is homologous with the large vesicles described by myself in *Protobonellia mitsukurii*.<sup>1</sup> The long-stalked

<sup>1</sup>. Ikeda, I.—Note on a New Deep-Sea Echiroid, *Protobonellia mitsukurii*: *Annot. Zool. Jap.*, Vol. VI, part 4, 1908.

funnels (Fig. 3, *fn*) are thickly clustered like a bouquet around the tertiary branches; it often occurs that the tertiaries give rise to a few short quarteries, to which 2-5 funnels are attached (Fig. 3). Generally those funnels (*fn'*) directly attached to the apices of canal branches are the largest. Some long secondaries as well as all the main canals are fixed to the integument by long but slender muscle-strands (Figs. 2 and 3, *fm*).

The vascular system does not show any remarkable feature, and is of the same structural type as that of *Hamingia arctica* or of the genera *Thalassema* and *Bonellia*. At a spot about 15 mm behind the pharynx, the ventral vessel (Fig. 4 *vv*) gives off a short branch (*niv*), the neurointestinal vessel. This vessel, about 15 mm long, attaches itself to the beginning of the mid-gut, about 5 mm apart from the anterior boundary of the collateral intestine (*ci*). The vessel is then divided into two short branches embracing the collateral intestine. It is quite peculiar that these two vessels on the mid-gut and a short length of the neurointestinal vessel (near the intestine), are provided with numerous, short, villus-like processes (*vp*). It seems very probable that these structures are of the same nature as the contractile villi of the dorsal vessel found in the Sipunculids. The so-called heart is in this species indistinct. The dorsal vessel (*dv*) arises from the terminal part of the fore-gut (about 5 mm in front of the anterior boundary of the collateral intestine), and proceeds forwards along the mid-dorsal line of, and finally attaches to, the pharynx.

The ovary (*ov*) is found along the posterior three-fifths of the ventral vessel (Fig. 2). There the vasculo-peritoneal epithelium is thickly studded with small egg-cells, which are capped with a nutritive cell-mass (Fig. 5). In these ovarian eggs the cellular cap is larger than the egg itself and shows an irregular cocoon-like shape. In the coelomic fluid floats a large number of larger egg-cells still retaining the cellular cap (Fig. 6). This fact and that the oviduct contains no eggs but fully mature males as will be seen farther on, lead us

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to a conclusion that this female specimen is full grown and had passed the spawning season.

The single unpaired oviduct (*ovd*) is found on the right side of, and very close to, the ventral nerve-cord (Fig. 7). Being very small (8 mm. long and 2 mm. thick) and completely hidden under the large pharynx, it can be seen only when the pharynx is removed. It consists of an elongate thin-walled sac and a short, narrow and thick-walled neck. It opens to the exterior by a pore situated, as already stated, about 8 mm. behind the anterior end of the body proper. A small fimbriated funnel (*of*) with a long stalk is present near the junction of the neck to the sac. No eggs are found in the oviduct. As we know in other Echiuroids, the small size of the oviduct indicates that this specimen was taken between breeding seasons.

Three males (Fig. 8) were found in the vesicular portion of the oviduct. They appear somewhat like a Nematode curled like S. The surface seems quite smooth to the naked eye. All are of the same size, being 4 mm. long and 0.173 mm. in maximum diameter. The entire surface is thickly and uniformly covered with short cilia. As in the female, no ventral hook is present.

The internal organization of the males is represented in Fig. 8 which is drawn from a borax-carmine preparation. The coelom is quite spacious throughout the greater part of the body (about 0.36 mm. long), excepting the two terminal portions where the parenchyme fills up the cavity.

The most conspicuous organ in the coelom is the spermatic reservoir (*sr*), a relatively long (2.3 mm.) and thick tubular sac filled with spermatozoa. Anteriorly the sac abruptly passes over into a narrow vas deferens (*vd*) which makes its way straightly forwards through the parenchyme to open to the exterior a little posterior and ventrad to the tip of body. Posteriorly the reservoir ends with a small, short-stalked, ciliated funnel (*sf*) which opens into the coelom.

The alimentary canal of the males are found in the same degenerated condition as in *Bonellia miyajimai* and *B. misakiensis*<sup>1</sup>, that is to say, it is cut up into small pieces, of which there are ten to be seen in Fig. 8 (al). They float in the coelom and may take any position as the animal moves.

Other coelomic contents are the floating sperm cell-masses (*spm*). Some of them consist of quite young cells, while others are in the last stages of spermatogenesis.

The ventral nerve-cord (*vnc*) can be fairly distinctly made out in the stained preparation. No ring-nerve is found around the spermduct. Neither blood vessels nor any trace of segmental organs are present.

So far as the general external feature (as, f. i., the general shape and relative size of the proboscis<sup>2</sup> and the texture of the smooth and translucent integument devoid of any sort of hook-like structures) of the female specimen is concerned, the present species is in agreement with both the Arctic and the East Indian forms. There are however remarkable differences between the two known species and the present; *i.e.*, (1) the yellowish red integument, the known forms being said to be "durchscheinend grün" (*Hamingia sibogae*) or "hell grasgrün" (*H. actica*); (2) the absence of the papillary appendices on the proboscis-tip (*H. sibogae*) or around the genital openings (*H. arctica*). The internal anatomy of the female of the present species agrees in the main with that of *Hamingia arctica*, but little with that of *H. sibogae*. It must here be noted that Sluiter's description of the internal anatomy is not full, since in his single specimen some parts of the viscera seem to have been greatly torn; he could not detect any trace of the gonad, the anal glands, and the collateral intestine. Neither is a description of blood-vessels

1. Ikeda, I.—The Gephyrea of Japan: Journ. Coll. Sci., Imp. Univ. Tokyo, Japan, Vol. XX, Art. 4, 1904.

2. The original description of Danielsen and Koren that *Hamingia arctica* is devoid of a distinct proboscis, was later corrected by Lankester, who observed a well developed proboscis nearly equal in length to the body proper.

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given. Moreover, he could not discover any parasitic male in his specimen. Thus, the identification of his specimen with *Hamingia* had been based entirely on external characters. It therefore seems to admit of a doubt if Sluiter's description can be considered to be sufficient to establish a distinct species upon it.

The most conspicuous point of difference shown by the females of *Hamingia arctica* and of the present species, is in the structure of the anal glands; namely, the number of the main canals, the presence or absence of vesicular portions, and the mode of arrangement of the funnels.

Lastly as to the specific distinction of the male individuals of the present species, no special mentioning may be needed; they are characterized by the absence of ventral hooks, by the highly degenerated intestine, and by the extremely long spermatic reservoir.

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## Explanation of the Plate.

Fig. 1.—Ventral view of the female. (*Nat. size*).

Fig. 2.—Terminal portion of the rectum (*rt*) with anal glands; *in situ*.

*av*, antero-ventral main-canal of the anal glands; *fm*, fixing muscles of the rectum and anal glands; *ml*, mid-lateral main-canal of anal glands; *ov*, ovary on the ventral vessel; *pd*, postero-dorsal main-canal of anal glands; *rd*, rectal diverticulum from which the three main-canals of anal glands arise separately. On the right hand side only the tertiary branches of the anal glands are represented.

× 1.5.

Fig. 3.—Terminal portion of a main-canal (postero-dorsal) of anal glands, which corresponds to a tertiary branch. Some of the funnels (*fn*) are seen arising from quartary branches. *fm*, fixing muscle; *fn'*, largest apical funnel. × × 55.

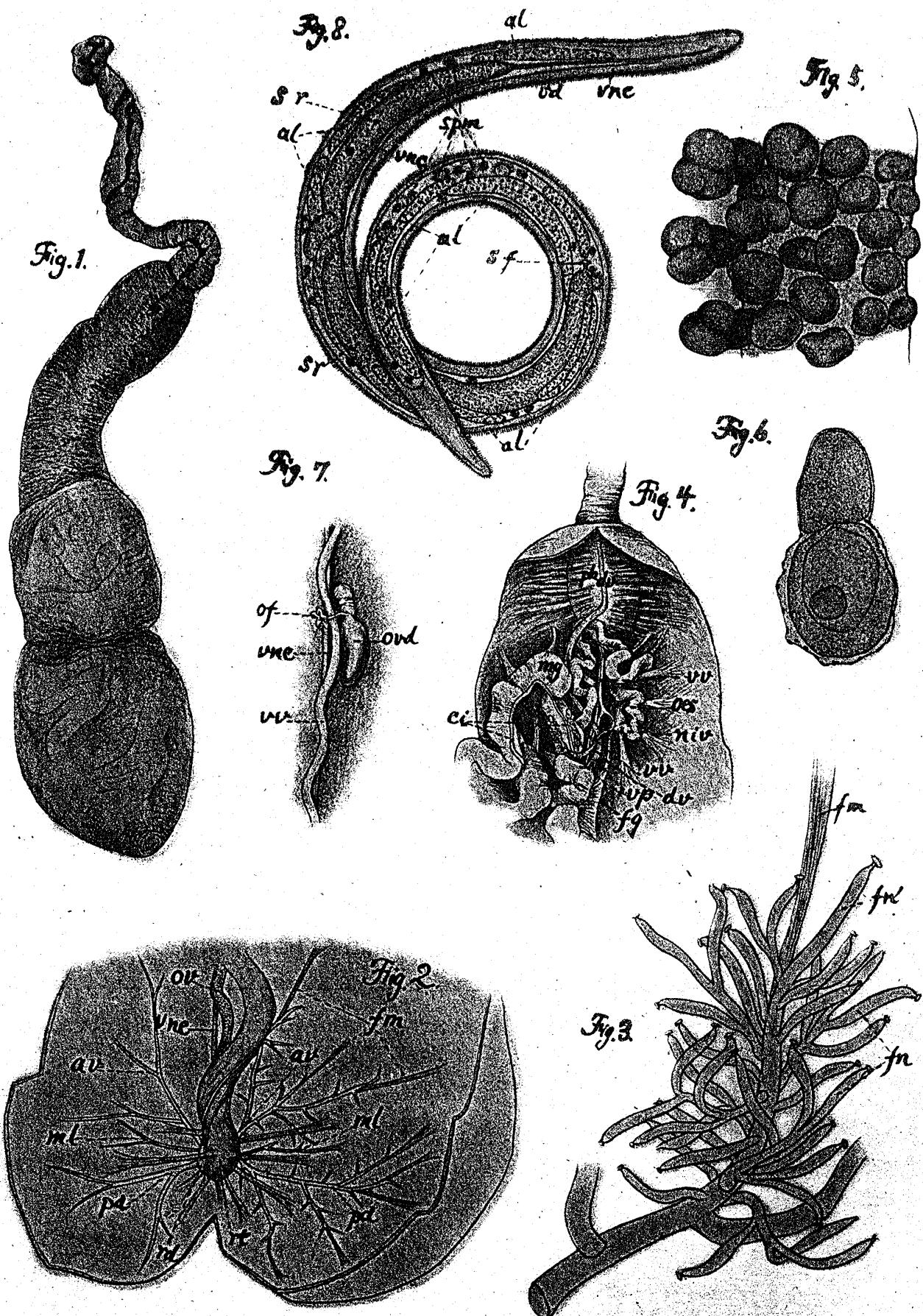
Fig. 4.—Anterior part of the viscera *in situ*. *Ci*, collateral intestine; *dv*, dorsal vessel; *fg*, fore-gut near the junction with the mid-gut (*mg*); *niv*, neurointestinal vessel; *oes*, oesophagus; *vp*, villus-like processes of the two vessels on the intestine; *vv*, ventral vessel. (*Nat. size*.)

Fig. 5.—Portion of the ovary (side-view). × 156.

Fig. 6.—Young floating egg with nutritive cell-cap. × 156.

Fig. 7.—Oviduct (*ovd*), the ventral nerve-cord (*vnc*) and the ventral vessel (*vv*); *of*, oviducal funnel opening into the coelome. × 2.

Fig. 8.—Male magnified; *al*, pieces of the alimentary canal; *sf*, funnel of the spermatic reservoir *sr*; *spm*, sperm cell masses; *vd*, vas deferens; *vnc*, ventral nerve-cord.



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(*Hamingia ijimai*).